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Quantum kinetic theory for QED and shear-induced spin polarization

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We derive a quantum kinetic theory for QED based on Kadanoff-Baym equation[1]. By assuming parity invariance and considering a complete set of self-energy diagrams, we find the resulting kinetic theory expanded to lowest order in $\hbar$ generalizes the well-known classical kinetic theory to massive case. It contains elastic and inelastic collision terms and integrates screening effect naturally. We also discuss generalization to QCD. The approach allows us to study complete collisional contribution to spin polarization in heavy ion collisions. We find a new collisional contribution to shear-induced spin polarization, which is not suppressed compared to contributions already included in current phenomenological studies. It may shed light on the spin polarization puzzle.

[1]Shu Lin, "Quantum Kinetic Theory for Quantum Electrodynamics" arxiv:2109.00184.

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